

IN THE SPECIFICATION:

Please replace paragraphs [003], [008], [010] , [013] , [014], [027], [028], [030], [031], [034], [035], [038], [042], [048], [052], [054], [058], [070] and [071] of the specification, with the following amended paragraphs, in which deleted terms are indicated with strikethrough and/or double brackets, and added terms are indicated with underscoring.

[003] In a method generally used by such ultrasonic washing equipment, an object to be washed is put into a washing tank containing cleaning liquid which is expelled internally from the top of the washing tank and, after the liquid is irradiated with an ultrasonic wave to subject [[of]] the object to ultrasonic deburring, the object to be washed is retrieved from the washing tank (see, for instance, Japanese Patent Application Laid-Open No. 64-34647 (Figure 1 through Figure 3)).

[008] In a method according to an aspect of the ~~invention~~ invention, the object to be washed is put in from a side of the washing tank through the inlet in the side wall of the washing tank, and after closing the inlet with the door, deaerated cleaning liquid is let into the washing tank to subject the object to be washed to ultrasonic washing. After the washing and after emptying the washing tank of the cleaning liquid and opening the door of the outlet in the side wall of the washing tank, the object to be washed is discharged through the outlet toward a side of the washing tank.

[010] The [[way]] manner of opening and closing the doors of the inlet and the outlet here among other features can be freely selected ~~only if~~ as long as they can pass the object to be

washed in an open state, and seal the side of the washing tank in a closed state.

[013] Further according to the invention, a plurality of tanks of substantially the same shape as the washing tank are arranged along one line beside the inlet and outlet of the washing tank, the washing tank and these tanks adjoining each other are disposed with their inlets and outlets arranged in mutually opposite positions, a common door is provided between each opposing pair of these inlets and outlets, and by opening or closing these doors the outlet and inlet are enabled to communicate with, or isolated from each other.

[014] By arranging the washing tank and the plurality of tanks along one line and washing the object to be washed while it is successively shifted from the upstream tank to the downstream tank, it is made possible to enhance, for instance, the washing effect or the rinsing effect; if in this arrangement a common door is provided between each [[couple]] opposing pair of these inlets and outlets of the adjoining washing tank and other tank, and the outlet and inlet are enabled to communicate with or ~~intercepted to be isolated~~ from each other by opening or closing these common doors, the object to be washed can be smoothly shifted to another tank, so that works successively delivered via a carriage route or the like can be smoothly washed. In addition, the use of the common doors enable the equipment to be reduced in size.

[027] The ultrasonic washing apparatus according to the depicted embodiment of the invention is intended to make the inputting and retrieval of the works in and out of the washing tank~~[[.]]~~ more efficient, for instance when putting works successively delivered from the machining line or the like to ultrasonic washing, and at the same to prevent the equipment from increasing in

vertical size; it is configured as, for instance, as deburring /washing equipment for valve bodies, which are an automobile component item.

[028] Thus, this ultrasonic washing equipment 1, as shown in Figure 1 and Figure 2, is provided with a shift route 3 for putting works delivered from a machining line or the like (not shown) into a washing tank 2[[,]] for washing and deburring the works. Another shift route 4 is provided for discharging washed works from the washing tank 2. A carriage route 5 is also disposed within the washing tank 2, an inlet 6 closable with a door 6h is disposed in the side wall on the side upstream from the washing tank 2 (the feed shift route 3 side), and an outlet 7 closable with a door 7h is disposed in the side wall on the side downstream from the washing tank 2 (the discharge shift route 4 side).

[030] An ultrasonic oscillator or an ultrasonic signal generator 2A, which is operable to ~~for~~ emitting emit/generate an ultrasonic wave/signal toward the cleaning liquid, is provided within the washing tank 2 and, as will be described afterwards, the cleaning liquid in the washing tank 2 can be replenished or discharged.

[031] The washing tank 2 is cleared of the cleaning liquid, the door 6h of the inlet 6 is opened, and the pinions 11 of the upstream shift route 3 and the pinions 11 of the carriage route 5 are rotationally driven to feed the carrier 8 into the washing tank 2. When the feeding is completed, the door 6h of the inlet 6 is closed ~~to let~~ and the cleaning liquid is let into the washing tank 2. Then an ultrasonic wave is emitted to deburry and wash the works.

[034] The washing tank 2 is provided with a cleaning liquid charging/discharging circuit 15 for charging and discharging the cleaning liquid in and out of the washing tank 2, an evacuating circuit 16 for ~~making~~ applying a vacuum to the interior of the washing tank 2 ~~vacuum~~, a deaerating circuit 17 for deaerating the cleaning liquid, and a circulating circuit 18 for circulating the cleaning liquid in the washing tank 2. The cleaning liquid charging/discharging circuit 15 is provided with a storage tank 12 capable of supplying or receiving the cleaning liquid and a water charging/discharging line linking the washing tank 2 and the storage tank 12.

[035] When a valve on the discharging side of the water charging/discharging line of the cleaning liquid charging/discharging circuit 15 is opened, the cleaning liquid in the washing tank 2 is discharged by its own weight into the storage tank 12. When the cleaning liquid in the storage tank 12 is to be returned into the washing tank 2, a valve on the charging side of the water charging/discharging line is opened after reducing the pressure within the washing tank 2 by working the vacuum pump 20 of the evacuating circuit 16, and the cleaning liquid is sucked into the washing tank 2.

[038] When the cleaning liquid is in the washing tank 2 and circulating in the circulating circuit 18, the deaerating circuit 17 receives part of the circulating cleaning liquid in circulation and, after deaerating it, returns that part of the liquid to the washing tank 2. When the cleaning liquid is in the storage tank 12, the circuit receives part of the cleaning liquid in the storage tank 12 and, after deaerating, returns that pat of the liquid to the storage tank 12. Then by removing gases dissolved in the cleaning liquid, the impact of the cavity during the emission of the ultrasonic wave is increased.

[042] When the carrier 8 is to be fed into the washing tank 2, the cleaning liquid in the washing tank 2 is shifted to the storage tank 12 via the water charging/discharging line of the cleaning liquid charging/discharging circuit 15, to prevent the cleaning liquid from flowing out even if the inlet 6 is opened. After that, the door 6h is opened and the pinions 11 of the shift route 3 and the carriage route 5 are rotationally driven. Then the carrier 8 is shifted into the washing tank 2 through the inlet 6.

[048] The works successively delivered from upstream can be efficiently washed in the procedure described above, and no extra trouble is involved in either moving the carriage 8 into or discharging the ~~carriage~~ carriage out of the washing tank 2.

[052] During operation of the multi-tank apparatus, the carrier 8, carried from the upstream shift route 3, is fed into the washing tank 33 via the first preparatory tank 31 and, after going through ultrasonic washing for deburring in the washing tank ~~[[2]]~~ 33, is discharged outside via the second preparatory tank 32.

[054] Cleaning liquid circuits of the first preparatory tank 31 and the second preparatory tank 32 are of substantially the same form. As shown in Figure 9, there are provided a cleaning liquid charging/discharging circuit 35 for charging or discharging the cleaning liquid into or out of the tanks 31 and 32, an evacuating circuit 36 for ~~making~~ reducing pressure within the interior of the tanks 31 and 32 ~~vacuum~~, a deaerating circuit 37 for deaerating the cleaning liquid, and a circulating circuit 38 for circulating the cleaning liquid in the tanks 31 and 32. These circuits are

configured in the substantially same way as their respective counterparts in the foregoing embodiment with some partial exceptions.

[058] Incidentally, the outlet 43 of the first preparatory tank 31 and the inlet 42 of the washing tank 33 are disposed in mutually adjacent positions, and so are the outlet 43 of the washing tank 33 and the inlet 42 of the second preparatory tank 32, and a common door 44 is provided between each opposing couple/pair of these tanks as shown in Figure 6. By opening or closing these doors 44, the outlet 43 and the inlet 42 are respectively caused to communicate with or be isolated from each other.

[070] ~~Since the~~ The ultrasonic washing apparatus according to the invention has an inlet and an outlet for admitting and discharging the object to be washed into and out of the washing tank are provided in side walls of the washing tank of the ultrasonic washing apparatus. The objects to be washed are charged and discharged sideways through these inlet and outlet, there is no need to move the object to be washed up and down, the works are successively delivered from the machining line, and moreover the equipment is not increased in vertical size.

[071] Further, if a plurality of tanks in substantially the same shape as the washing tank are arranged along one line beside the inlet and outlet of the washing tank, opposing pairs of their inlet and outlets are positioned opposite each other and a common door is disposed between the ~~inlet and outlet~~ pair, it is made possible to enhance the washing effect by the use of the plurality of tanks and to achieve a rinsing effect, moreover enabling the equipment to be reduced in size.